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Remote actuator for parking brake control assembly.

The subject invention (20) provides a hand or foot operated park brake actuator (30) connected to a drive reel (48) via a flexible motion transmitting core element (68). The drive reel (48) is connected to an isolator crank (56) via a lost motion connection (46). The isolator crank (56) is operatively connected to a control crank (76) which, in turn, directly actuates the park brake (26). The control crank (76) includes a lock sector (102) which coacts with a pawl (104) to selectively maintain the park brake (26) in a brake applied condition. When in the brake applied condition, the lost motion connection (46) allows the drive reel (48) to return to an unactuated position thereby eliminating all stresses from the actuator (30). The pawl (104) includes an elongated slot (108) and a trip spring (110) which coact to alternatively ratchet the pawl (104) against the lock sector (102) and then to disengage the pawl (104) from the lock sector (102) without requiring an independent release mechanism.

REMOTE ACTUATOR FOR PARKING BRAKE CONTROL ASSEMBLY

TECHNICAL FIELD

The subject invention relates to a control assembly for actuating the parking brake of a vehicle, and more particularly to a completely mechanical control assembly having a remote manual actuator.

BACKGROUND ART

Manually operated park brake control assemblies are typically positioned in the passenger compartment of a vehicle adjacent the operator and present a hand or foot operated lever to be manually operated by the vehicle operator for applying, or setting, the park brake. Generally, the hand or foot operated lever is supported on a pivot and integrally attached to a ratchet mechanism for maintaining the control assembly in an actuated condition in order to hold the park brake in the brake applied condition. The park brake is released by triggering some form of independent release mechanism.

Such prior art park brake control assemblies have two significant disadvantages. First, the entire mechanism must be located inside the passenger compartment. The physical size of the control assembly inside the passenger compartment prevents optimal use of the space in which it is located. As vehicle designs seek to conserve and better utilize all available space in the passenger compartment, such large and bulky park brake control assemblies become a greater design burden. Therefore, the first deficiency in the prior art park brake control assemblies relates to their inherently large size coupled with the unavoidable requirement that they be positioned inside the passenger compartment.

Second, flexible motion transmitting core elements, or cables, are typically used to interconnect the park brake control assembly and the park brakes at the rear wheels of the vehicle. As one park brake is located at each of the two rear wheels of most vehicles, two such cables must extend the majority of the distance between the control assembly and the park brakes. These cables must be of relatively high tensile strength because tensile forces in excess of 90 pounds can be generated between the control assembly and park brake during actuation, and maintained therebetween for very long periods of time. It will be appreciated that such high tensile strength cables are costly, heavy, and in addition are difficult to install and service due to their stiffness.

The U.S. Patent Number 4,795,002 to Burgei et al, issued January 3, 1983, discloses an electronic

park brake control assembly located adjacent the brakes and having a remote actuator located inside the passenger compartment. Such fully electronic systems have not gained wide acceptance due to unreliability and difficulty in diagnosing the cause of system failures. Purely mechanical control assemblies are preferred in most situations yet cannot be divorced of their above-described disadvantages.

SUMMARY OF THE INVENTION AND ADVANTAGES

The subject invention contemplates a manually operated vehicular park brake assembly comprising an actuator means for mechanically transmitting forces applied by a vehicle operator, and a control means for receiving forces from the actuator means and selectively maintaining a park brake in a brake applied condition in response to the forces. The invention is characterized by an isolator means for isolating the forces between the actuator means and the control means while the control means maintains the park brake in the brake applied condition to remove stresses from the actuator means and thereby improve the operating efficiency of the system.

The subject invention overcomes the disadvantages inherent in the prior art by providing the isolator means which allows the stresses which occur while the park brake is in a brake applied condition to be completely isolated from the actuator means. From this it follows that the actuator means can be fabricated from lower strength, lower cost materials and hence supplies the necessary incentive to space the isolator means and the actuator means apart from each other as far as possible. The isolator means of the subject invention makes advantageous separating the actuator means from the control means so that only the actuator means need be provided inside the passenger compartment of the vehicle. The control means and the isolator means, on the other hand, can be located outside the vehicle, inside the vehicle trunk, or in some other ergonometically advantageous position.

BRIEF DESCRIPTION OF THE DRAWINGS

Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Figure 1 is an environmental view of the subject

invention disposed for use in a vehicle;

Figure 2 is a plan view of an actuator according to the invention, with the cover removed to show the control means and isolator means;

Figure 3 is a view similar to Figure 2, but partially schematicized to show the invention in an unactuated condition;

Figure 4 is a view similar to Figure 3, with the invention shown in the brake applied condition with the actuator means fully actuated;

Figure 5 is a view similar to Figure 4, with the subject invention shown in the brake applied condition with the actuator means returned to an unactuated position;

Figure 6 is a view similar to Figure 5, with the subject invention shown with the actuator means reactuated to disengage the pawl from the lock sector and return the assembly to the unactuated condition;

Figure 7 is an enlarged detail view of the ratchet means of the subject invention shown in the unactuated condition corresponding to Figures 2 and 3;

Figure 8 is a view similar to Figure 7, with the lock sector moving into ratcheting engagement with the pawl;

Figure 9 is a view similar to Figure 8, with the pawl in engagement with the lock sector corresponding to Figure 4;

Figure 10 is a view similar to Figure 9, showing the trip spring moving over center of the pin to prepare the pawl for disengagement corresponding to Figure 5;

Figure 11 is a view similar to Figure 10, showing the pawl disengaged from the lock sector corresponding to Figure 6; and

Figure 12 is a view similar to Figure 11, showing the recock arm preparing to move the pawl over center of the pin as the control crank moves back to the unactuated position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the Figures, wherein like numerals indicate like or corresponding parts throughout the several views, the subject park brake assembly is generally indicated at 20. In Figure 1, the assembly 20 is shown in connection with a vehicle, generally indicated at 22. The vehicle 22 includes two rear wheels 24 each having a brake assembly. Each of the brake assemblies is provided with a park brake 26 used by the vehicle operator to set the vehicle 22 in a braked condition while not in use. The rear wheels 24 may be supported on a common axle 28, as is well known in the art.

The subject assembly 20 is manually operated and therefore includes an actuator means, gen-

erally indicated at 30, for mechanically transmitting forces applied by a vehicle operator to the park brakes 26. As shown in Figures 1 and 3-6, the actuator means 30 includes a lever 32 which is pivoted about a fulcrum 34 thereof in response to the forces applied by the vehicle operator. Although the lever 32 is shown in the accompanying Figures as being of the foot operated type, it will be appreciated by those skilled in the art that a hand operated actuator operates in substantially the same manner to yield the same result as the disclosed foot operated lever 32. The lever 32 is disposed inside the passenger compartment of the vehicle 22 in an easily accessed location for the vehicle operator, such as underneath the dashboard in the case of a foot operated lever 32, or alternatively underneath the dashboard or adjacent the driver's seat in the case of a hand operated lever.

The subject invention also includes a control means, generally indicated at 36, which is supported substantially within a protective housing 38, shown with its cover removed for clarity. The control means 36 receives forces from the actuator means 30 and selectively maintains the park brake 26 in a brake applied condition in response to such forces. In other words, as the operator rotates the lever 32 about its fulcrum 34, forces are mechanically transferred to the control means 36, which then transmits such mechanical forces to the park brake to maintain the park brake in a brake applied condition.

The subject invention is characterized by including an isolator means, generally indicated at 40, which is also disposed within the housing 38. The isolator means 40 functions to isolate the forces between the actuator means 30 and the control means 36 while the control means 36 maintains the park brake 26 in the brake applied condition to thereby remove stresses from the actuator means 30 and improve the operating efficiency of the assembly 20. The isolator means 40 is disposed between and interconnects the actuator means 30 and the control means 36 and prevents the feedback of stresses to the actuator means 30 while the control means 36 holds the park brake 26 in the brake applied condition. Therefore, the stress isolating function of the isolator means 40 operates only when the control means 36 maintains the park brake 26 in the brake applied condition.

Referring now to Figures 2-6, the isolator means 40 includes an input means, generally indicated at 42, for interconnecting the actuator means 30 and the isolator means 40. The isolator means 40 also includes an output means, generally indicated at 44, for interconnecting the control means 36 and the isolator means 40. The isolator means 40 includes a lost motion connection, gen-

erally indicated at 46, which is disposed between and interconnects the input means 42 and the output means 44. Therefore, the lost motion connection 46 is disposed between the actuator means 30 and the control means 36.

The input means 42 includes a bell-shaped drive reel 48 which is pivotally supported for arcuate movement about an isolator pivot 50. As shown in the Figures, the bell-shape of the drive reel 48 is formed by two straight edges 52 intersecting at an apex and joining to a common curved camming edge 54. The isolator pivot 50 is disposed between the two edges 52 adjacent the apex, with the camming edge 54 forming a concentric arc segment about the isolator pivot 50.

The output means 44 includes an isolator crank arm 56 which is also pivotally supported for arcuate movement about the isolator pivot 50 but is independently moveable of the drive reel 48. That is, the drive reel 48 and isolator crank 56 are moveable relative to each other in arcuate paths about the isolator pivot 50.

The lost motion connection 46 interconnects the drive reel 48 and the isolator crank 56. More specifically, as best shown in Figures 2-6, the lost motion connection 46 includes an arcuate slot 58 which is formed in the drive reel 48 and disposed concentrically about the isolator pivot 50. A finger 60 extends from the distal, free swinging, end of the isolator crank 56 and is disposed within the arcuate slot 58. The finger 60 is confined at all times within the slot 58 for movement between a first 62 and a second 64 terminal end of the arcuate slot 58.

The isolator means 40 further includes a biasing means 66 which interconnects the drive reel 48 and the isolator crank 56. The biasing means 66 urges the drive reel 48 in a first predetermined arcuate direction, clockwise as viewed in Figures 2-6, relative to the isolator crank 56. More particularly, the biasing means 66 comprises a flat wound coil spring, also known as a spiral torsion spring, having a radially displaced end operatively connected to the finger 60 and another end adjacent its center connected to the drive reel 48. The spring 66 constantly urges the drive reel 48 clockwise about the isolator pivot 50 but, due to the housing 38, is prevented from clockwise movement past the position shown in Figure 2.

Referring to Figures 1-6, the actuator means 30 includes an elongated motion transmitting means 68 which interconnects the lever 32 and the drive reel 48 for mechanically transmitting motion between the lever 32 and the drive wheel 48 along a curved path. More specifically, the motion transmitting means 68 comprises a flexible cable having a first end 70 connected to the lever 32 and a second end 72 connected to the drive reel 48 at a

connection 74. The second end 72 of the cable 68 is wound about the exterior of the drive reel 48, i.e., about the camming edge 54, in order to effect rotation of the drive reel 48 about the isolator pivot 50 in response to pivotal movement of the lever 32 about its fulcrum 34. As the vehicle operator urges the lever 32 to pivot about its fulcrum 34 when applying the park brake, the cable 68 is displaced a corresponding distance and mechanically urges the drive wheel 48 to rotate about the isolator pivot 50.

In Figures 2-6, the control means 36 is shown including a control crank arm 76 which is operatively connected to the isolator crank 56 for arcuate movement about a control pivot 78. A rigid link 80 extends between opposite ends thereof with one of the ends being pivotally connected to the isolator crank 56 and the other end pivotally connected to the control crank 76. Therefore, as the isolator crank 56 rotates about the isolator pivot 50, the control crank 76 is urged to rotate about the control pivot 78. The control pivot 78 and the isolator pivot 50 are spaced from one another and so disposed as to rotate the respective control crank 76 and isolator crank 56 in parallel planes.

The control means 36 includes at least one, and preferably two, brake throws 82, 84 which extend radially outwardly of the control pivot 78 and are integrally connected to the control crank 76. The two brake throws 82, 84 are disposed on opposite sides of the control pivot 78. The control crank 76 extends radially outwardly from between the two brake throws 82, 84, at an angle slightly less than 90° from the one brake throw 82 and slightly greater than 90° from the other brake throw 84.

The control means 36 further includes two cables 86 having one end connected to one of the brake throws 82, 84 and the other ends operatively connected to a respective park brake 26 at one of the two rear wheels 24. Each cable 86 is connected to one of the brake throws 82, 84 for interconnecting the associated brake throw 82, 84 with one of the park brakes 26. A slug 88 is disposed on the end of each of the cables 86 for attachment to the respective brake throw 82, 84.

An automatic fastener means, generally indicated at 90 in Figure 2, is provided for automatically fastening the slug 88 of each cable 86 to its associated brake throw 82, 84 in response to a coupling force applied to interconnect two elements. The automatic fastener means 90 includes a resilient latch 92 extending integrally from each brake throw 82, 84. A cup shaped pocket 94 is provided in each brake throw 82, 84 for receiving the slug 88. The latch 92 is resiliently disposed to support the slug 88 in the respective pockets 94 yet allow easy insertion of the slugs 88 into the

pockets 94 for installation purposes. A cable passage 96 is provided through the housing 38 for each of the cables 86. Similarly, a flexible element passage 98 is provided through the housing 38 for the flexible cable 68.

Referring now to Figures 2-12, the control means 36 is shown including a ratchet means, generally indicated at 100, for locking the control crank 76 in an angular position in response to a first applied force from the actuator means 30 and for unlocking the control crank 76 in response to a second successively applied force from the actuator means 30. The ratchet means 100 operates in toggle fashion by locking the control crank 76 in a brake applied condition in response to a first applied force from the actuator means 30, and then reversing itself and automatically unlocking the control crank 76 solely in response to a second successively applied force from the actuator means 30.

The ratchet means 100 includes a saw-toothed lock sector 102 comprising a series of ramps, or barbs, which coast with a pawl 104. The pawl 104 is supported on a pin 106 and adapted to engage the teeth of the lock sector 102 in ratcheting fashion. As perhaps best shown in Figures 8-12, the pawl 104 includes an elongated slot 108 which surrounds the pin 106 and serves to interconnect the pawl 104 and the pin 106.

The ratchet means 100 further includes a strategically located trip spring 110 which exerts a compressive force between the housing 38 and the pawl 104 for urging the pawl 104 to ratchetingly engage the lock sector 102 in response to the first applied force from the actuator means 30, and then for urging the pawl 104 to disengage from the lock sector 102 in response to a second applied force from the actuator means 30.

More particularly, in Figure 7 the pawl 104 is shown in spacial relation to the lock sector 102 in an unactuated condition corresponding to Figures 2 and 3. As the lever 32 is pivoted about its fulcrum 34 to apply a first force to the control crank 76, the lock sector 102 rotates about the control pivot 78 until the pawl 104 makes initial contact with the lock sector 102 as shown in Figure 8. This causes the pawl 104 to move relative to the pin 106 from the position shown in Figure 7, wherein the pin 106 is generally centered in the elongated slot 108 to the position shown in Figure 8, where the pin 106 is disposed in engagement with the rearward edge of the elongated slot 108.

This movement of the pawl 104 relative to the pin 106 causes the trip spring 110 to direct its biasing force on one side of the pin 106 and thereby apply a force on the pawl 104 tending to urge it in the clockwise direction, in ratcheting engagement with the lock sector 102. Therefore, as

the lock sector 102 continues to rotate about the control pivot 78, the pawl 104 and lock sector 102 ratchet to the position shown in Figure 9. Figure 9 corresponds to the schematic illustration of Figure 4 wherein the lever 32 has been fully actuated and the park brakes 26 have been placed in a brake applied condition.

As the vehicle operator releases the first applied force on the lever 32 the lock sector 102 rotates in reverse, or counter clockwise, direction about the control pivot 78, causing the pawl 104 to move rearwardly relative to the pin 106 until the pin 106 engages the forward edge of the elongated slot 108. This causes the trip spring 110 to move onto the opposite side of the pin 106 and thereby urges the pawl 104 to rotate in a counter clockwise direction about the pin 106. However, because the pawl 104 is engaged with the teeth of the lock sector 102, the pawl 104 and lock sector 102 remain operatively engaged to maintain the brake throws 82, 84 in a brake applied condition, as illustrated in Figure 10.

When the operator applies a second successive force to the lever 32, as represented in Figure 6, to move the lock sector 102 slightly about the control pivot 78 in a clockwise direction, the trip spring 110 urges the pawl 104 to disengage the lock sector 102 as shown in Figure 11. With this, the isolator means 40 ceases to isolate the forces between the control means 36 and the actuator means 30 as that the vehicle operator may gradually move the park brakes 26 from the brake applied condition back to an unactuated condition as shown in Figures 2 and 3.

The control crank 76 includes a recock arm 112 for urging the pawl 104 to engage the lock sector 102 after the second force has been applied by the actuator means 30. More particularly, the recock arm 112 and the pawl 104 include coacting camming surfaces which urge the pawl 104 to move relative to the pin 106 within the slot 108 so that the trip spring 110 will once again urge the pawl 104 in a clockwise direction about the pin 106 to ratchet with the lock sector 102.

OPERATION OF THE PREFERRED EMBODIMENT

Referring to the Figures, the operation of the preferred embodiment will be addressed presently. From the unactuated position shown in Figures 2 and 3, the vehicle operator applies a force to the lever 32 rotating it about its fulcrum 34. This, in turn, displaces the cable 68 such that the attached drive reel 48 is caused to rotate about the isolator pivot 50. With the first end 62 of the arcuate slot 58 in engagement with the finger 60, movement of the drive reel 48 concurrently urges the isolator crank

56 about the isolator pivot 50. By way of the rigid link 80, the control crank 76 is caused to rotate in a clockwise direction about the crank pivot 78 in response to counter clockwise movement of the isolator crank 56 about the isolator pivot 50. Such movement of the control crank 76 simultaneously causes each of the brake throws 82, 84 to displace their associated cables 86, thereby actuating the park brake 26 and causing the lock sector 102 to ratchetingly engage the pawl 104.

As the brake throws 82, 84 rotate about the control pivot 78, they apply an increasingly greater leverage about the control pivot 78 upon the cables 86. That is, as the brake throws 82, 84 rotate toward the brake applied condition, each of the cables 86 begin to move closer to the control pivot 78, thereby increasing the leverage while decreasing the displacement of the cables 86. In the preferred embodiment, the ratio will increase from the unactuated condition shown in Figures 2 and 3 at about 3.5:1 to a ratio as high as 4:1 in the fully applied condition as shown in Figures 4-6.

While the pawl 104 is engaged with the lock sector 102 to maintain the park brake 26 in a brake applied condition, the biasing means 66 urges the drive reel 48 to rotate in a clockwise direction back toward an unactuated position as shown in Figure 5. Such retracting movement of the drive reel 48 urges the lever 32 back toward its unactuated position via the cable 68.

To release the park brakes 26 from the brake applied condition, the lever 32 is urged back toward its brake applied position until the first end 62 of the arcuate slot 58 contacts and slightly displaces the finger 60. This slight displacement of the finger 60 causes the control crank 76 to move a small arcuate degree in the clockwise direction about the control pivot 78 allowing the pawl 104 to disengage from the lock sector 102. The lever 32 is then slowly moved by the vehicle operator from the position shown in Figure 6 back to the position shown in Figure 3 and thereby gradually releasing the park brake 26 to an unactuated condition.

The primary advantage of the subject invention is that the isolator means 40 completely isolates the lever 32 and flexible cable 68 from the forces on the control means 36 while the park brakes 26 are maintained in a brake applied condition. More specifically, tensile forces of 90 pounds or greater may be required to maintain park brakes 26 in a brake applied condition. Hence, each of the cables 86 are required to withstand such a 90 pound tensile load for extended periods of time, and therefore must be constructed of very durable material. However, as the cable 68 is never required to maintain such a tensile load for any length of time greater than the brief moment required to actuate or deactuate the park brakes 26, the cable

68 can be fabricated from a much less durable, lighter and less expensive material.

Hence, the isolator means 40 supplies the necessary incentive to design the assembly 20 with the inexpensive flexible cable 68 spanning the greatest distance and the two heavy and expensive cables 86 spanning a minimal distance. Therefore, as shown in Figure 1, the housing 38 can be positioned adjacent the rear axle 28 with each of the cables 86 extending a relatively short distance to their associated park brake 26. The inexpensive and light flexible cable 68, on the other hand, can be routed from the housing 38 adjacent the rear axle 28 to the lever 32 disposed within the passenger compartment of the vehicle. Additionally, the only structure required inside the passenger compartment of the vehicle 22 is the lever 32 and its support fulcrum 34. The relatively bulky control means 36 is positioned in an unobtrusive space, freeing the valuable interior space for maximum occupant comfort.

The invention has been described in an illustrative manner, and it is to be understood that the terminology which has been used is intended to be in the nature of words of description rather than of limitation.

Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims wherein reference numerals are merely for convenience and are not to be in any way limiting, the invention may be practiced otherwise than as specifically described.

Claims

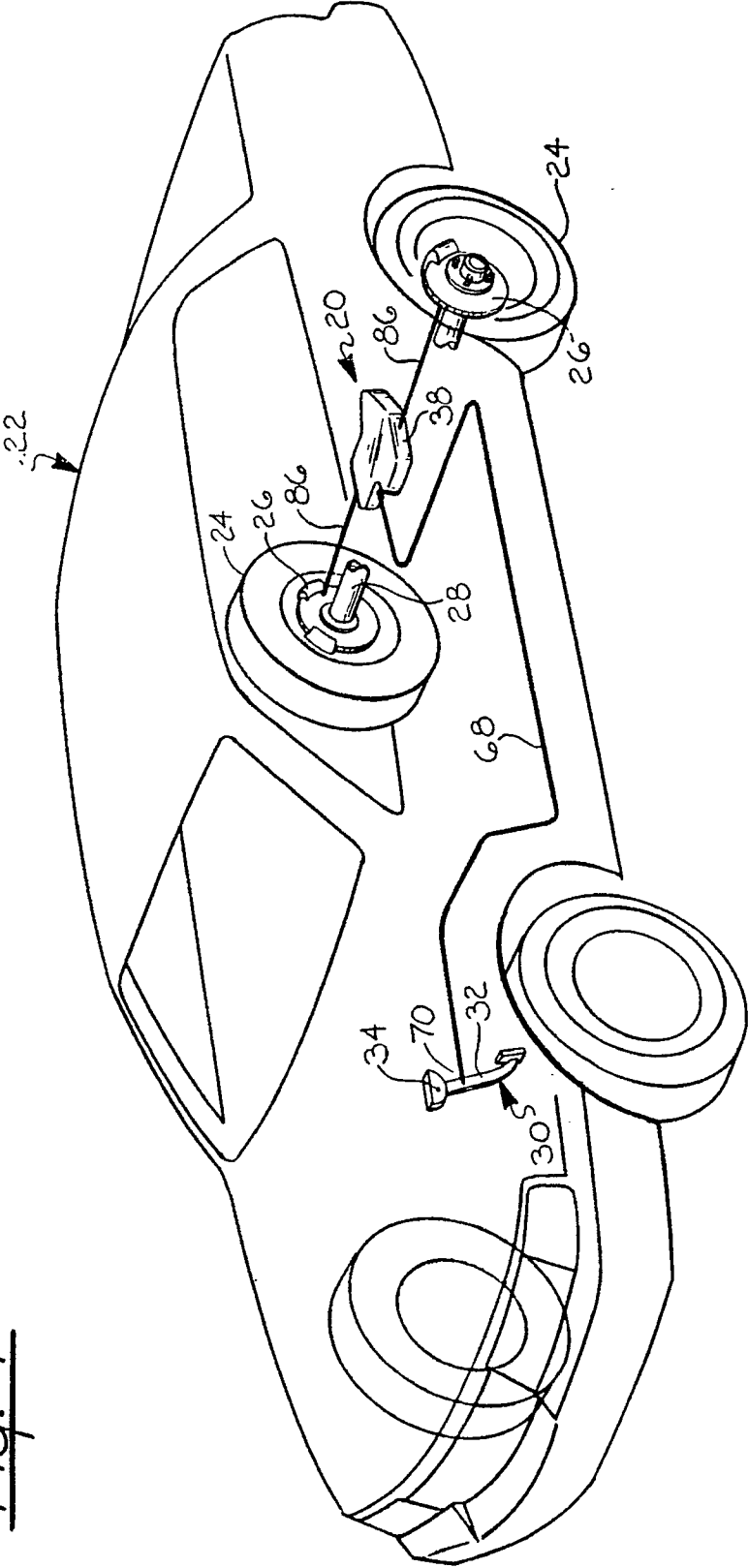
1. A manually operated vehicle park brake comprising: an actuator (30) for applying and releasing a park brake (26) in response to operation by a vehicle operator, a control assembly (20) operatively connected to the actuator (30) and including a control (36) for the park brake (26), and a latch (100) for latching the control (36) in brake-applied position, characterized by the control assembly including an isolator device (40) for operatively connecting the actuator (30) to the control (36) to apply the park brake, and for operatively disconnecting the actuator (30) from the control (36) when latched to isolate the control (30) from brake apply stresses.
2. The park brake of claim 1, further characterized by the isolator (40) including a lost motion connection (46).

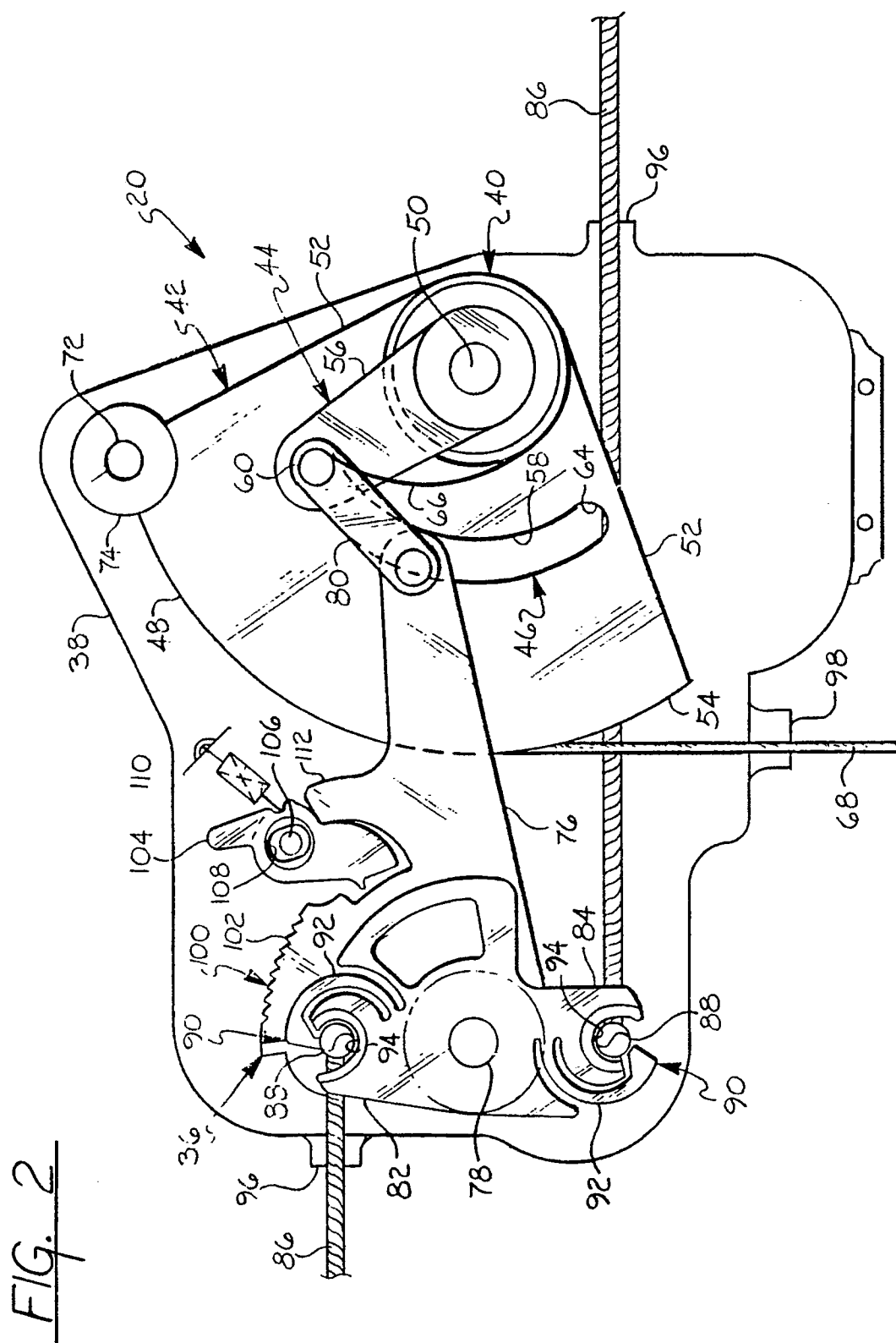
3. The park brake of claim 2, further characterized by the isolator (40) including an input (42) connected to the actuator (30) and an output (44) connected to the control (36).
4. The park brake of claim 3, further characterized by a lost motion connection (46) interconnecting the input (42) and the output (44).
5. The park brake of claim 4, further characterized by the input (42) including a drive reel (48) mounted for pivotal movement about an isolator pivot (50), the output (44) including an isolator crank arm (56) mounted for pivotal movement about the isolator pivot (50) independently of the drive reel (48), and by the lost motion connection (46) interconnecting the drive reel (48) and the crank arm (56).
6. The park brake of claim 5, further characterized by the lost motion connection (46) including an arcuate slot (58) having a slot end (62) formed in the drive reel (48) and disposed concentrically about the isolator pivot (50) and a drive pin (60) confined within the arcuate slot (58) and extending from the crank arm (56), whereby the drive reel slot end (62) engages the drive pin (60) to move the crank arm (56) and apply the park brake.
7. The park brake of claim 6, further characterized by the isolator (40) including a spring (66) biasing the drive reel (48) in a direction to disengage the slot end (62) from the drive pin (60) when the control (36) is latched in brake-apply position.
8. The park brake of claim 7, further characterized by the actuator (30) including a pedal lever (32), a flexible operating cable (68) interconnecting the lever (32) and the drive reel (48).
9. The park brake of claim 8, further characterized by the control (36) including a control crank arm (76) operatively connected to the isolator crank (56) by a drive link (80) connected to the drive pin (60).
10. The park brake of claim 2, further characterized by the control (36) including a control crank arm (76) operatively connected to the isolator crank (56) by a drive link (80).
11. The park brake of claim 10, further characterized by the control (36) including at least one brake throw (82, 84) extending radially outwardly of the control pivot (78) and integrally

connected to the control crank (76).

12. The park brake of claim 11, further characterized by the latch (100) including a lock sector (102) having a plurality of teeth disposed integrally along one edge of the control crank (76), a pawl (104) for engaging the teeth and having a slot (108), and a pin (106) received in the slot (108).
13. The park brake of claim 12, further characterized by the latch (100) including a trip spring (110) urging the pawl (104) to engage the teeth when the pawl is in latch position with pin (106) at one end of the slot upon movement of the control crank (76) to brake-apply position, and urging the pawl (104) to disengage the teeth when the pawl is in release position with pin (106) at the other end of the slot (108).
14. The park brake of claim 13, further characterized by the control crank (76) including a re-cock arm (112) for moving the pawl (104) to latch position when the control crank is moved to brake-release position.

FIG. 1





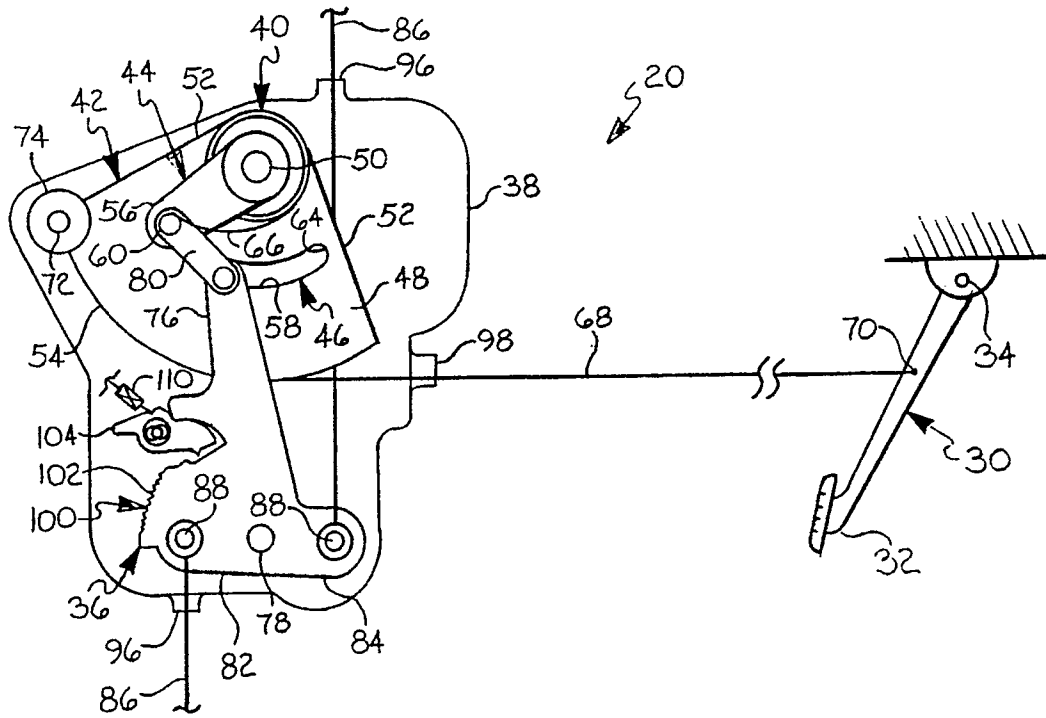


FIG. 3

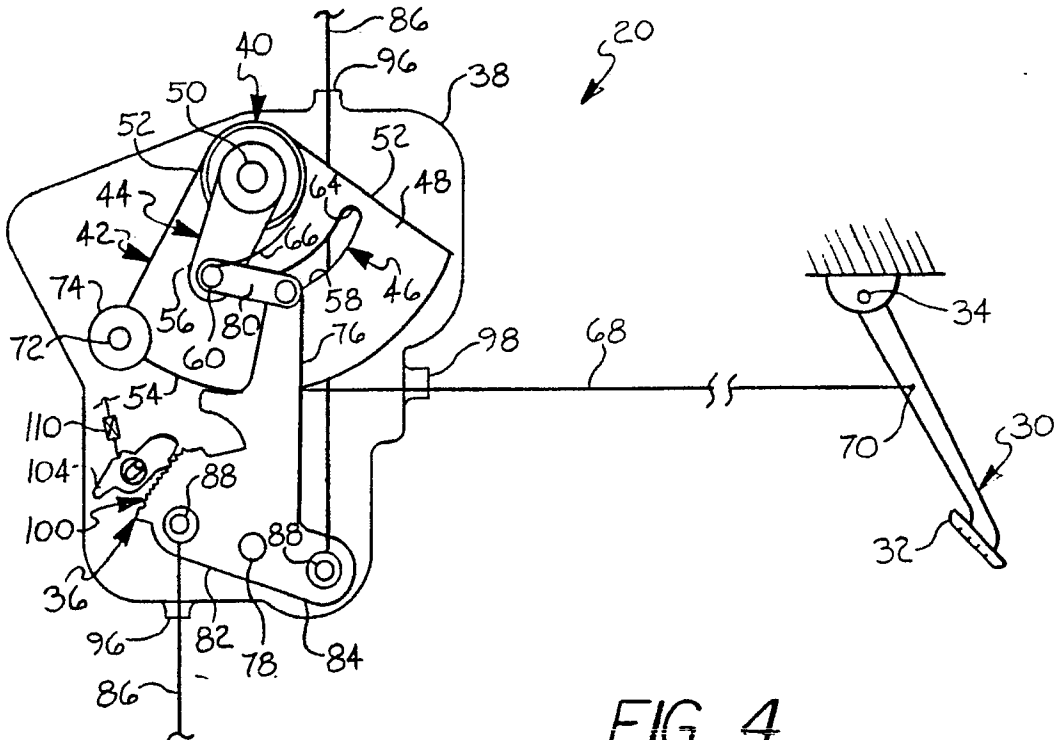


FIG. 4

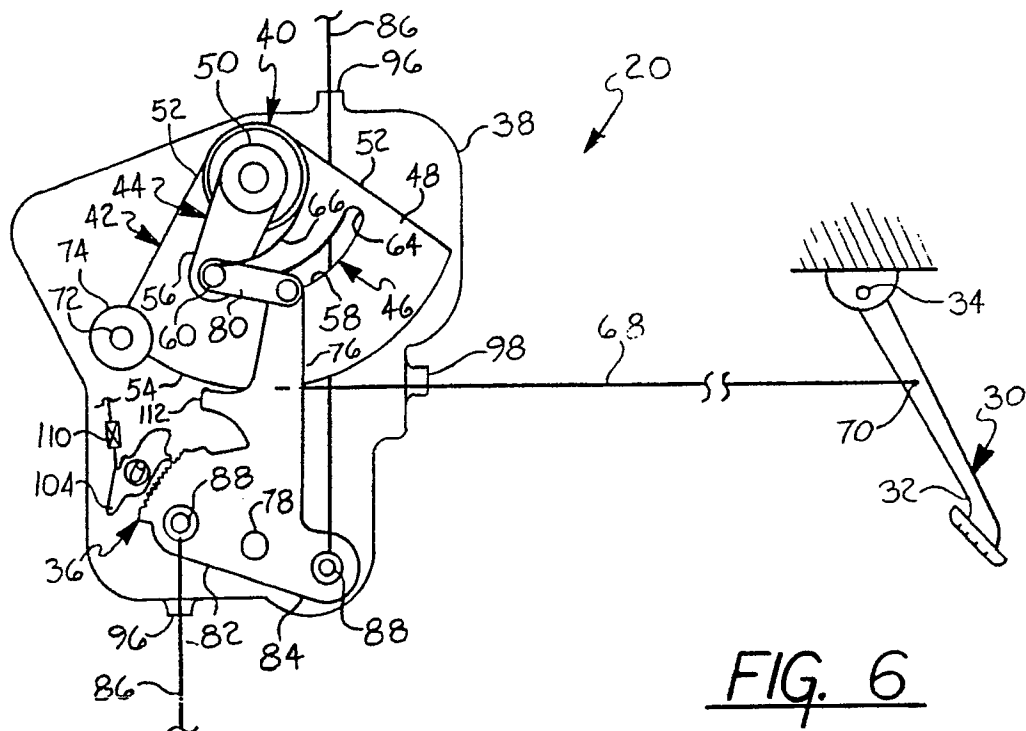
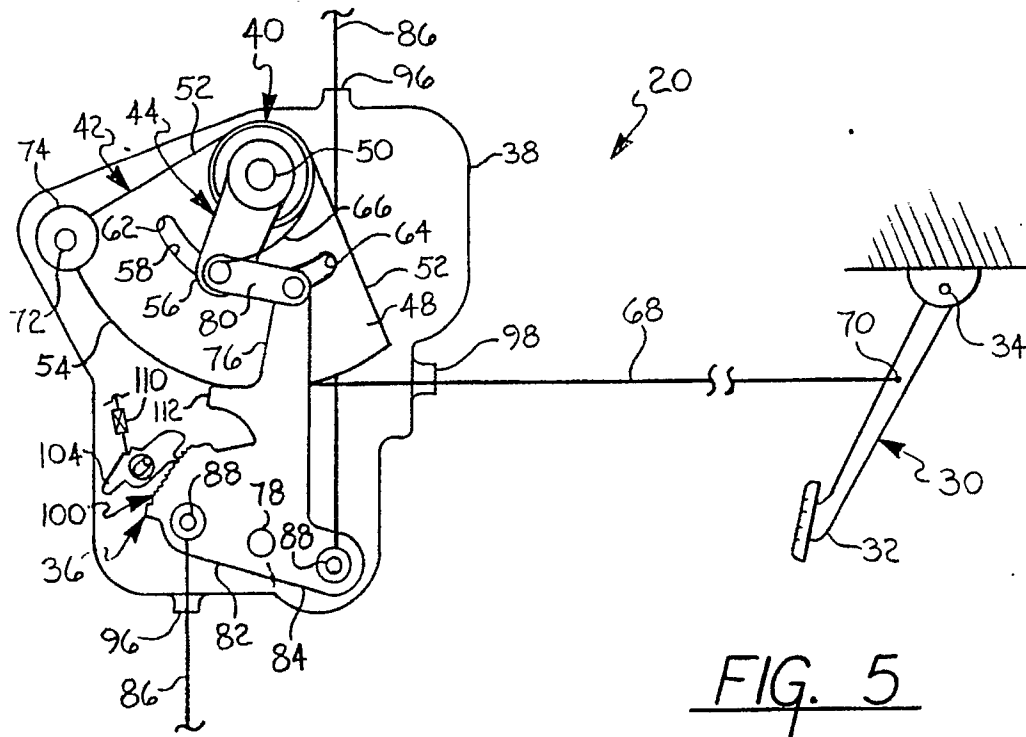


FIG. 8

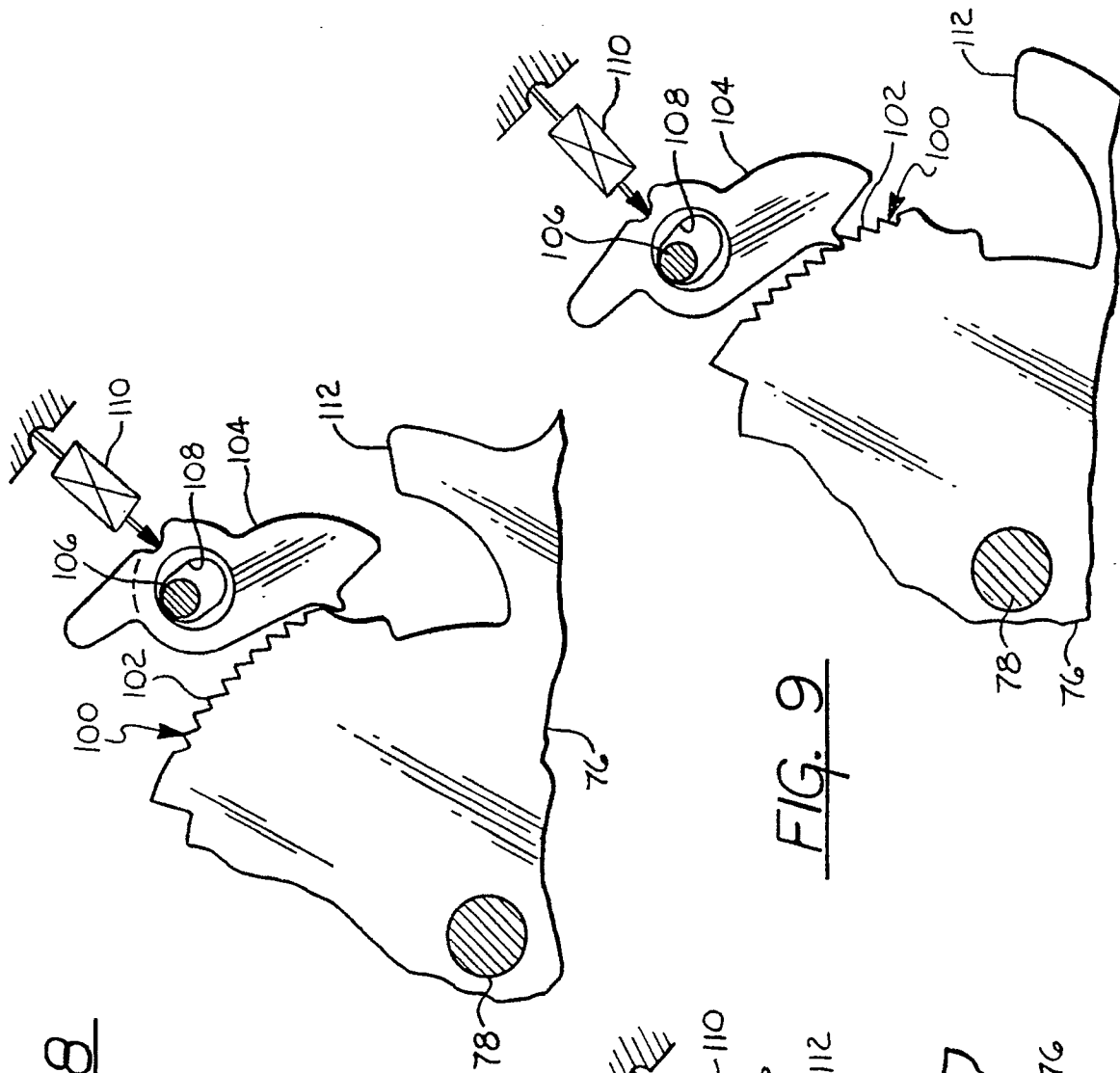


FIG. 7

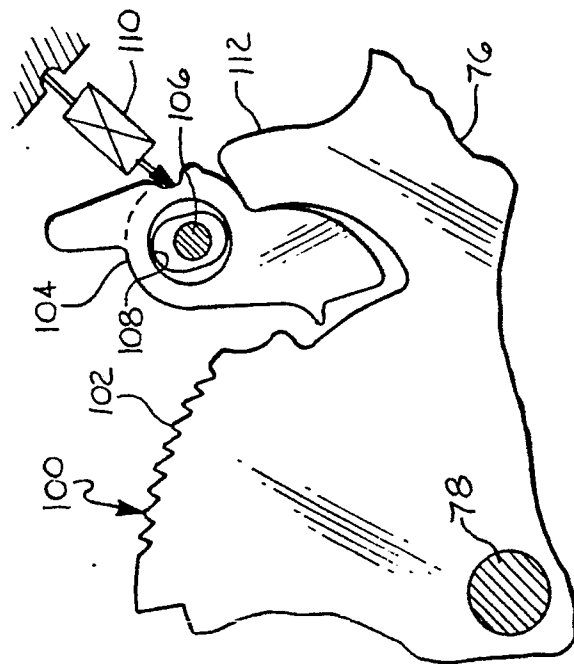
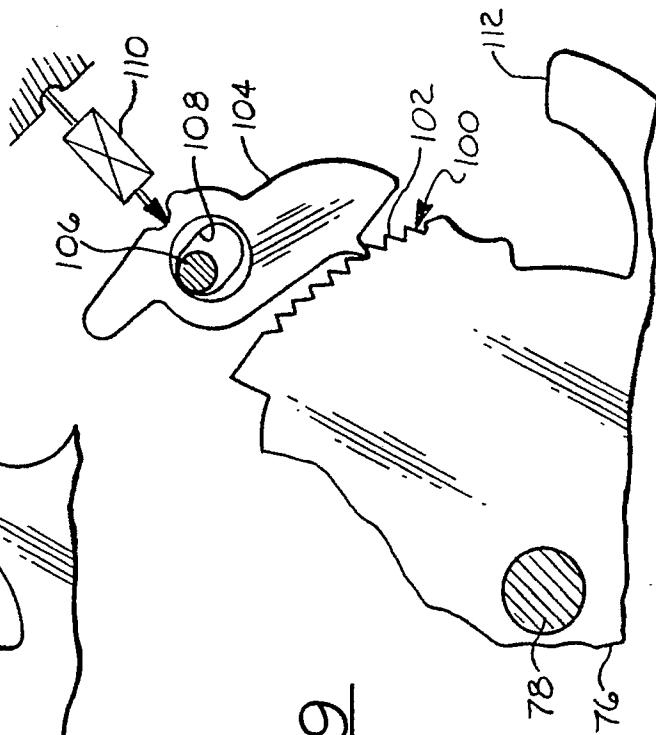


FIG. 9



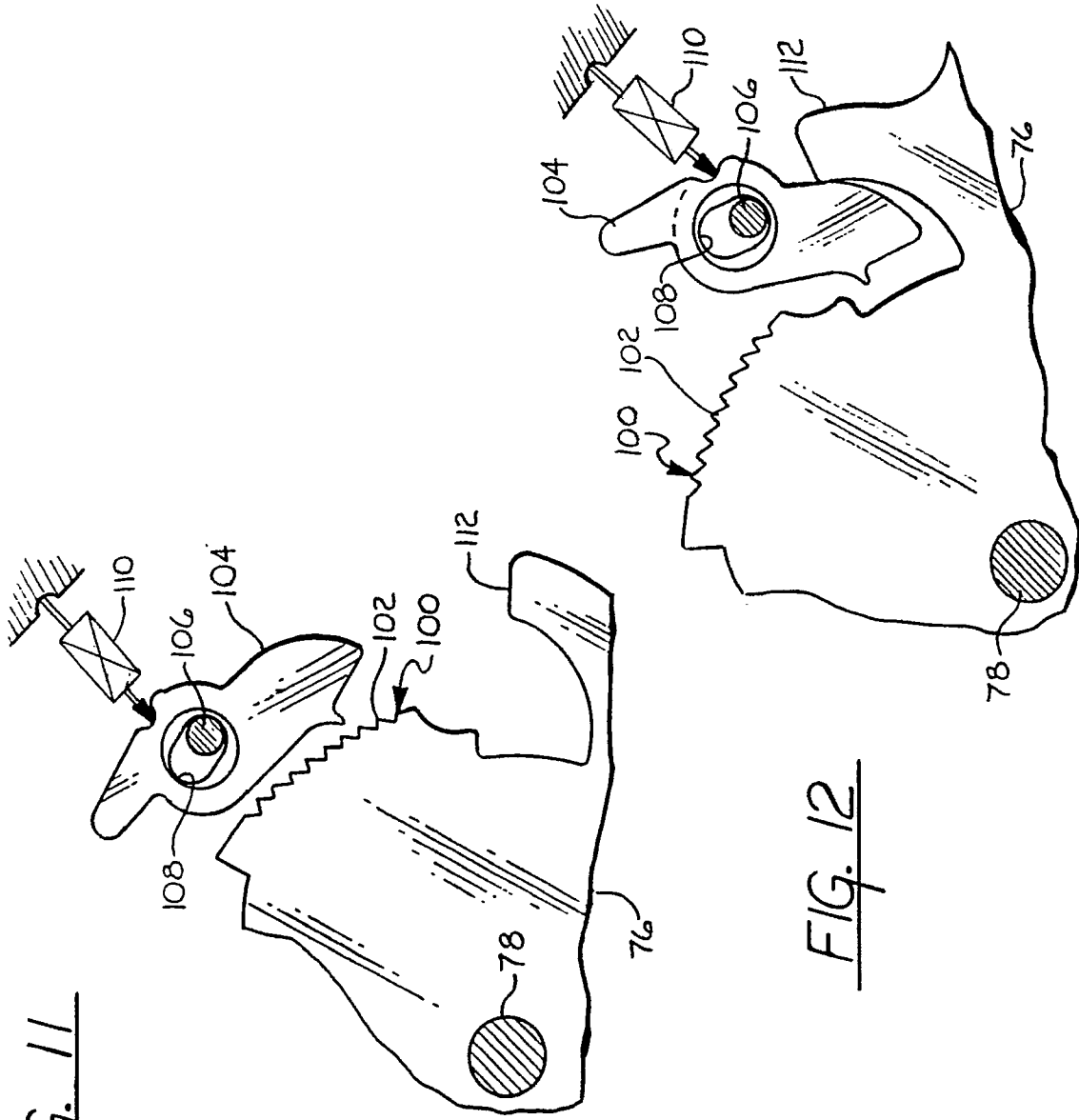


FIG. 11

FIG. 12

FIG. 10

